

## Science Bowl Questions 1994

### Round 9

#### **Toss-Up**

1. ERSC; Multiple Choice: Which of the following is a sedimentary rock?

- a) Granite
- b) Limestone
- c) Gneiss
- d) Marble

ANSWER: B – LIMESTONE

#### **Bonus**

1. ERSC; Multiple Choice: Determine the rock pair with the closest relationship.

- a) Shale & Slate
- b) Limestone & Marble
- c) Limestone & Sandstone
- d) Granite & Rhyolite

ANSWER: D – GRANITE & RHYOLITE (RHYOLITE IS MERELY EXTRUSIVELY COOLED GRANITE)

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#### **Toss-Up**

2. BIOL; Multiple Choice: The class Reptilia is divided into subclasses based on:

- a) the scale patterns
- b) the articulations in the vertebral column
- c) the number of openings in the temporal area of the skull
- d) shell characteristics of the egg

ANSWER: C – THE NUMBER OF OPENINGS IN THE TEMPORAL AREA OF THE SKULL

#### **Bonus**

2. BIOL; Multiple Choice: Which of these groups includes the extant amphibians?

- a) Holocephali
- b) Labyrinthodontia
- c) Lepospondyli
- d) Lissamphibia

ANSWER: D - LISSAMPHIBIA

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### **Toss-Up**

3. COMP; Multiple Choice: The algorithm, most efficient for large  $n$ , has which of the following complexity functions?
- a) order  $n$  squared
  - b) order  $n$  cubed
  - c) order  $n \log n$
  - d) order 2 to the  $n$ th power

ANSWER: C – ORDER  $N \log N$

### **Bonus**

3. COMP; Short Answer: What is the name of the test for measuring the success of computer programs that are claimed to have “Artificial Intelligence”?

ANSWER: TURING (TEST)

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### **Toss-Up**

4. PHYS; Multiple Choice: Starting from rest, a disk rotates with constant angular acceleration. If it takes 10 revolutions to reach an angular velocity  $w$ , then how many additional revolutions are required to reach an angular velocity  $2w$ ?
- a) 10 rev
  - b) 20 rev
  - c) 30 rev
  - d) 40 rev

ANSWER: C – 30 REV

### **Bonus**

4. PHYS; Multiple Choice: What is the underlying physical property that influences the index of refraction as measured at the interface between two transparent substances?
- a) the particle-wave duality of light
  - b) the color of the two substances
  - c) the constancy of the speed of light in a vacuum
  - d) the speed of light in the two substances

ANSWER: D – THE SPEED OF LIGHT IN THE TWO SUBSTANCES

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**Toss-Up**

5. GENR; Short Answer: What inventor said: “Genius is one percent inspiration and 99 percent perspiration”?

ANSWER: THOMAS EDISON

**Bonus**

5. GENR; Short Answer: What Greek physician is known as The Father of Medicine?

ANSWER: HIPPOCRATES

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**Toss-Up**

6. CHEM; Short Answer: The lanthanide series of elements is also known as:

ANSWER: RARE EARTH ELEMENTS

**Bonus**

6. CHEM; Short Answer: Who received the 1934 Nobel Prize in chemistry for his discovery of deuterium?

ANSWER: (HAROLD) UREY

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### **Toss-Up**

7. ASTR; Multiple Choice: If the Sun sets at 6:00 pm and the Moon rises three hours later, what phase is the moon in?
- a) first quarter
  - b) waxing crescent
  - c) waning gibbous
  - d) waning crescent

ANSWER: C – WANING GIBBOUS

### **Bonus**

7. ASTR; Short Answer: A reflecting telescope with a diameter of 6 meters has a Cassegrain hole that covers four percent of the total collecting area. What is the diameter of the Cassegrain hole in meters?

ANSWER: 1.2 meters

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### **Toss-Up**

8. BIOL; Multiple Choice: There are no green or blue pigments in frog skin, yet many frogs are green. The color is caused by reflection from guanine crystals in the:
- a) melanophores
  - b) iridiophores
  - c) xanthophores
  - d) erythrophores

ANSWER: B - IRIDIOPHORES

### **Bonus**

8. BIOL; Multiple Choice: If you have the DNA sequence of CGTCAG, what is its corresponding mRNA sequence?
- a) TACTUA
  - b) GACTGC
  - c) GCAGUC
  - d) GCAGTC

ANSWER: C - GCAGUC

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### **Toss-Up**

9. MATH; Short Answer: On a nationwide standardized test, students' scores were normally distributed with a mean score of 60 and a standard deviation of 10. What percent of the students scored above 60?

ANSWER: 50 (50%)

### **Bonus**

9. MATH; Multiple Choice: On the nationwide standardized test with a mean score of 60 and a standard deviation of 10, there were 100,000 students who took the test. Approximately how many students scored above 90?
- a) 1
  - b) 10
  - c) 100
  - d) 1000

ANSWER: C – 100

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### **Toss-Up**

10. PHYS; Multiple Choice: Two balls are dropped from a height of 8 m. Ball A bounces up to a height of 4m, whereas ball B bounces up to 2 m. Which ball experiences the larger impulse during its collision with the floor?
- a) Ball A
  - b) Ball B
  - c) It is impossible to tell without knowing the masses of the balls
  - d) It is impossible to tell without knowing the durations of the collisions

ANSWER: C – IT IS IMPOSSIBLE TO TELL WITHOUT KNOWING THE MASSES OF THE BALLS

### **Bonus**

10. PHYS; For each North pole there is an associated South pole. Describe a necessary feature of magnetic field lines.

ANSWER: MAGNETIC FIELD LINES ALWAYS FORM CLOSED LOOPS

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**Toss-Up**

11. CHEM; Short Answer: Then inventor of the Kelvin temperature scale was:

ANSWER: SIR WILLIAM THOMSON (LORD KELVIN)

**Bonus**

11. CHEM; Short Answer: "Under the same conditions of temperature and pressure, the volumes of reacting gases and of their gaseous products are expressed in ratios of small whole numbers." This law is attributed to:

ANSWER: GAY-LUSSAC

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**Toss-Up**

12. COMP; Short Answer: You have a small positive integer stored in a 32-bit word. Shifting the word left four bits is the same as multiplying by what decimal number?

ANSWER: SIXTEEN (16)

**Bonus**

12. COMP; Short Answer: Find a two-digit string that represents twice the value in hexadecimal as it does in octal

ANSWER: 00, 10, 20, 30, 40, 50, 60, or 70 (ANY OF THESE IS ACCEPTABLE)

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### **Toss-Up**

13. BIOL; Multiple Choice: In the fluid mosaic model of the cell membrane of biological membranes, what is true of the hydrophilic heads of the lipids?
- a) they readily dissolve in lipids
  - b) they are nonpolar
  - c) they are found deep within the bilayer
  - d) they are the inner and outer surface of the membrane

ANSWER: D – THEY ARE THE INNER AND OUTER SURFACES OF THE MEMBRANE

### **Bonus**

13. BIOL; Multiple Choice: You are looking at a species of mammal which you have never seen before. You see that it has sharp incisors and has molars. The digestive system is long and there is a large cecum. What can you deduce about the animal's diet?
- a) nothing, there is too little information
  - b) the animal is a strict carnivore
  - c) the animal is an herbivore
  - d) the animal is an insectivore

ANSWER: C – THE ANIMAL IS AN HERBIVORE

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### **Toss-Up**

14. ASTR; Multiple Choice: Supernovas, transient bright spots observed in our galaxy, are caused by the collapse and explosion of stars at the end of their lives. The common assumptions regarding the aftermath of such an event include all but one of the following. Which is the erroneous statement?
- a) The remnants form “cosmic clouds” of stellar gases and dust that become dispersed throughout the galaxy
  - b) A supernova remains but its brightness dims to a level beyond our detection limits.
  - c) A neutron star can be formed.
  - d) Material in the collapsing star can be sucked into a “Black Hole.”

ANSWER: B – A SUPERNOVA REMAINS BUT ITS BRIGHTNESS DIMS TO A LEVEL BEYOND OUR DETECTION LIMITS

### **Bonus**

14. ASTR; Short Answer: Approximately how many trillion miles are there in one parsec (within 10%)?

ANSWER: 19 TRILLION MILES (ACCEPT 17-21)

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### **Toss-Up**

15. PHYS; Multiple Choice: A varying force is plotted on a graph versus time. What physical quantity is represented by the area under curve?
- a) work
  - b) velocity
  - c) acceleration
  - d) impulse

ANSWER: D – IMPULSE

### **Bonus**

15. PHYS; Multiple Choice: Although there was a breakthrough in 1987 in which the transition temperature of certain ceramic superconductors was observed to be higher than the temperature at which nitrogen boils at atmospheric pressures, many applications involving superconducting wires have not been achieved to date. Which property of the materials best explains this?
- a) density
  - b) brittleness
  - c) color
  - d) coefficients of expansion

ANSWER: B – BRITTLENESS

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### **Toss-Up**

16. CHEM; Multiple Choice: Which of the following best describes nylon?
- a) acrylic
  - b) polyester
  - c) polyolefin
  - d) polyamide

ANSWER: D – POLYAMIDE

### **Bonus**

16. CHEM; Short Answer: How many nearest neighbor atoms are there for an atom in a monatomic body-centered cubic structure.

ANSWER: EIGHT (8)

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**Toss-Up**

17. ERSC; Short Answer: When an alpine glacier near a coastal area disappears and the sea invades the resulting trough, a deep, steep-sided inlet is created. Name this area.

ANSWER: FIORD

**Bonus**

17. ERSC; Short Answer: Name the epoch which identifies the most recent ice age.

ANSWER: PLEISTOCENE EPOCH

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**Toss-Up**

18. GENR; Short Answer: What is the middle day of a non-leap year?

ANSWER: JULY 2

**Bonus**

18. GENR; Short Answer: what museum houses the Elgin Marbles and the Rosetta Stone?

ANSWER: THE BRITISH MUSEUM (LONDON)

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### **Toss-Up**

19. PHYS; Short Answer: How many VHF television channels are there?

ANSWER: TWELVE (12)

### **Bonus**

19. PHYS; Short Answer: There are TV channels on both sides of the FM radio band. The audio portion of one TV channel can be heard on an FM radio at about 88 megahertz. Which channel is it?

ANSWER: SIX (6)

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### **Toss-Up**

20. BIOL; Multiple Choice: Purines (nitrogen bases) are found in DNA. Identify their chemical structure.

- a) one ringed
- b) two ringed
- c) three ringed
- d) straight chain

ANSWER: B – TWO RINGED

### **Bonus**

20. BIOL; Multiple Choice: Of the enzymes used during DNA replication, which one is responsible for the final joining of Okasaki fragments?

- a) helicase
- b) gyrase
- c) single strand binding protein
- d) ligase

ANSWER: D – LIGASE

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**Toss-Up**

21. CHEM; Short Answer: What is the term for the loss of water of crystallization from a hydrate when exposed to air?

ANSWER: EFFLORESCENCE

**Bonus**

21. CHEM; Short Answer: Name the chemist who earned the 1903 Nobel Prize in Chemistry for developing the theory of electrolytic dissociation

ANSWER: (SVANTE) ARRHENIUS

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**Toss-Up**

22. PHYS; Short Answer: Name the rarest of all observed radioactive events when two neutrons are converted into two protons, two electrons, and two neutrinos, which is observed in uranium-238, and germanium-76.

ANSWER: DOUBLE-BETA DECAY

**Bonus**

22. PHYS; What do experiments on double-beta decay suggest about neutrinos?

ANSWER: THAT THEY HAVE MASS (ACCEPT THAT THEY MAY HAVE MASS)

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### **Toss-Up**

23. MATH; Short Answer: If  $f(x) = x^2 - 3x + 1$ , what is  $f(2)$ ?

ANSWER: -1

### **Bonus**

23. MATH; Multiple Choice:  $x^2 + y^2 = z$  describes

- a) a cone
- b) a cylinder
- c) a sphere
- d) a hyperbola

ANSWER: A – A CONE

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### **Toss-Up**

24. BIOL; Multiple Choice: DNA replication is said to be:

- a) semi-conservative
- b) dispersive
- c) conservative
- d) continuous

ANSWER: A – SEMI-CONSERVATIVE

### **Bonus**

24. BIOL; Multiple Choice: During DNA replication, the synthesis of the new strand of DNA nucleotides relies on the formation of a particular kind of bond between the sugars of each nucleotide. What type of bond is formed?

- a) hydrogen
- b) ionic
- c) phosphodiester
- d) glycosidic

ANSWER: C - PHOSPHODIESTER

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### **Toss-Up**

25. CHEM; Short Answer: If the temperature of the surroundings increased 45 degrees on a Fahrenheit thermometer, the increase on a Celsius thermometer would be:

ANSWER: 25 DEGREES

### **Bonus**

25. CHEM; Short Answer: How many hydrogen atoms are there in the stright chain alkane that has ten carbon atoms?

ANSWER: 22

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